STAFF REPORT

OPERATOR AND LANDLORD PARTICIPATION IN SOIL EROSION CONTROL IN THE MAPLE CREEK WATERSHED IN NORTHEAST NEBRASKA

ESCS Staff Report NRED 80-4

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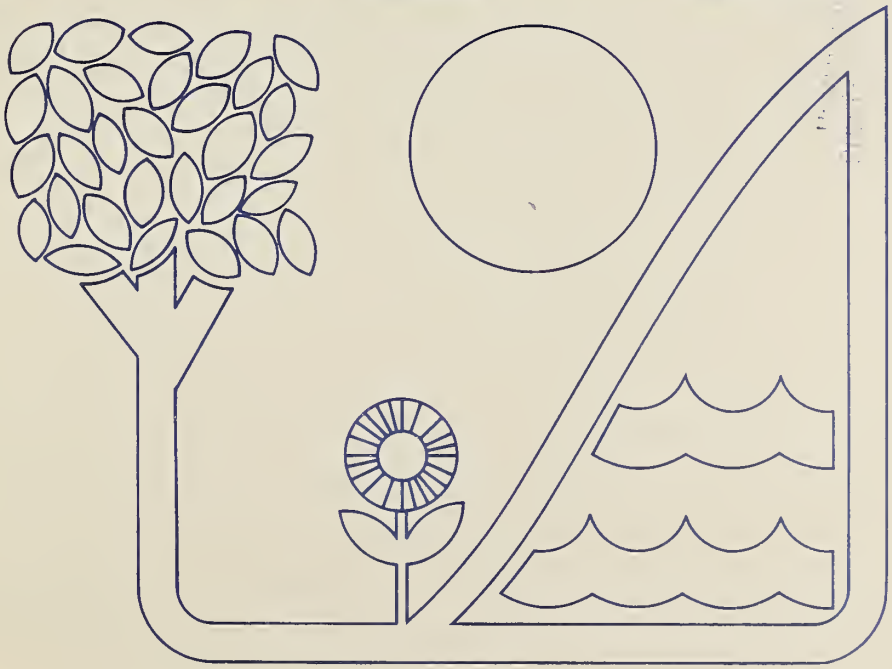
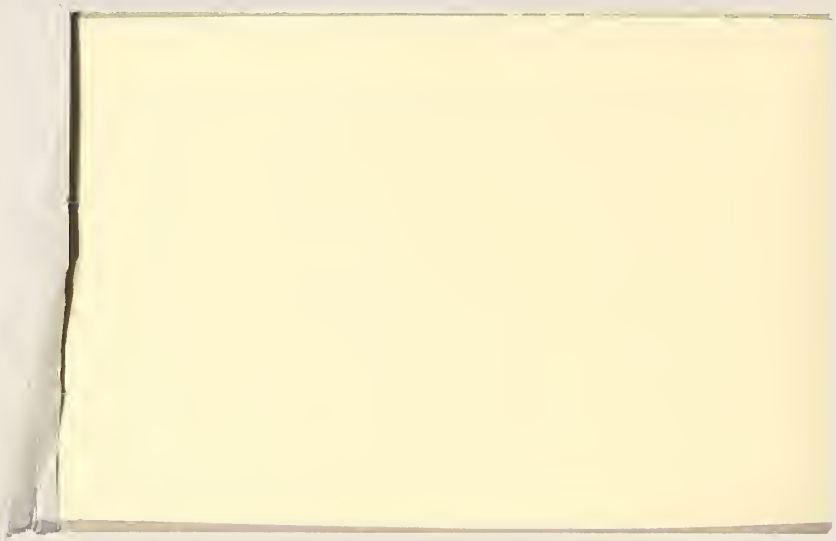
NRE Economics, Statistics, and Cooperatives Service

United States Department of Agriculture





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ABSTRACT

Responses of a sample of 106 operators and 69 landlords concerning degree of soil erosion, use of conservation practices, and factors hindering adoption of selected practices are described. Operator and landlord views of the seriousness of soil erosion differed from SCS estimates. Operators and landlords may not have skills to assess the economic or physical severity of the problem. Few used recommended erosion control practices. Main obstacles to adoption were low levels of cost sharing in 1977 and views of the soil erosion problem.

Key words: Cost sharing; soil erosion; conservation practices; obstacles; operators and landlords; Maple Creek Watershed; Model Implementation Project.

ACKNOWLEDGEMENTS

Many individuals in the U.S. Soil Conservation Service, the Survey Division of the Economics, Statistics, and Cooperatives Service and the Natural Resource Economics Division of the Economics, Statistics, and Cooperatives Service contributed expertise in the development of the operator and landlord questionnaire used in this survey. Norman Landgren contributed greatly to the conception and Bob McKusick to the execution of the study. However, any errors in the report are the responsibility of the authors.

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SUMMARY

This report describes the responses of 106 sample operators and 69 landlords concerning the degree of soil erosion, use of conservation practices and factors affecting their adoption in the Maple Creek MIP area in northeast Nebraska.

The average age of operators was about 45 years which was slightly lower than the state average. The average operator had been on his present farm 18 years. Few operators had off-farm jobs.

The most prevalent type of farm was a combination cash grain and livestock operation (86 percent). Farms averaged 293 acres with corn being the basic crop.

The primary type of farm organization was the individual or family farm (94 percent). Only two percent were incorporated and these reported fewer than 10 stockholders.

The typical operator reported four conservation practices in use on the farm. The two most popular practices were crop residue management (86 percent) and waterways (80 percent). These are estimates of the use of practices and do not measure the quality or extent of use of these practices on farms. Contouring, stripcropping and terraces were not very popular.

Survey results point to a large disparity between the Soil Conservation Service estimates of the soil erosion hazard on farms and operator and landlord views of the soil erosion problem in the Maple Creek MIP area. The SCS classified 82 percent of the farms as having a major soil erosion problem while only two percent of the operators and none of the landlords classified their farms

similarly. Moreover, 54 percent of the operators and 55 percent of the landlords indicated either no or few erosion problems; yet SCS classified only four percent as having no problem. Reasons for this wide variation in response were not obtained in the survey. However, the authors suggest the following as being important. SCS classifies soil erosion problems in terms of the amount of soil movement. Operators are more likely to classify problems in terms of the difficulties caused by soil erosion, the visibility of soil movement and the short run effect of erosion on the economic, physical and operational aspects of farming.

Information developed in this study identified several important variables associated with current use of conservation practices and their significance in the likely adoption of additional practices. Physical factors include farm size and current use of conservation practices. Larger farms tend to use more practices than smaller farms. This relationship could be due to the greater opportunity for problems to exist and the need for a variety of practices. Farms with high levels of practices have operators who more often express the need for wider use of conservation practices.

Cost sharing and assistance received from SCS are factors positively associated with levels of current conservation practice use. These factors can be viewed as institutional factors since they are administered by government agencies. The number of practices show a positive association with numbers of farm plans. Thus, government participation is positively and significantly associated with higher levels of current use of conservation practices as well as with the

likely adoption of additional practices when funds become available for cost sharing.

Personal factors associated with practice use are age, perception of the soil erosion problem and tenure. A greater proportion of younger operators agreed with SCS estimates of soil erosion problems on their farms. Operators that recognized an erosion problem in turn tended to use more practices. If operators do not conceive that a problem exists, they are unlikely to adopt practices. Finally, operators residing on their farms less than 10 years agreed more closely with SCS about the severity of soil erosion on their farms. These operators used more practices than those operators who did not view soil erosion as being a major problem.

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INTRODUCTION

Seven states were chosen in 1978 to develop Model Implementation Projects (MIP) to demonstrate the effectiveness of Best Management Practices (BMP's) in reducing nonpoint sources of water pollution. Selections were made from 50 applications submitted by 42 states. Projects are located in Indiana, Nebraska, New York, Oklahoma, South Carolina, South Dakota and Washington. Financial and technical assistance will be coordinated and accelerated in these areas. Economic and water quality monitoring and evaluation will be carried out to measure the impacts of the program's efforts.

The Maple Creek Watershed in Northeast Nebraska was one of the seven MIP's chosen for study. A 34,000 acre subarea of the Maple Creek Watershed above the town of Clarkson was selected for intensive monitoring and study (Figure 1). Nebraska state agencies joined forces with the U.S. Department of Agriculture and the Environmental Protection Agency to accelerate the MIP program in the Maple Creek Watershed. Because of limited funds and time, a small area within the watershed was selected for detailed analysis to better control the testing of selected management practices and their effects of runoff and water quality.

Conservation and pollution control measures are installed on a voluntary basis. Measures include the building of terraces, animal waste systems, erosion control structures and management practices and the grassing of road banks, streambanks and drainageways.

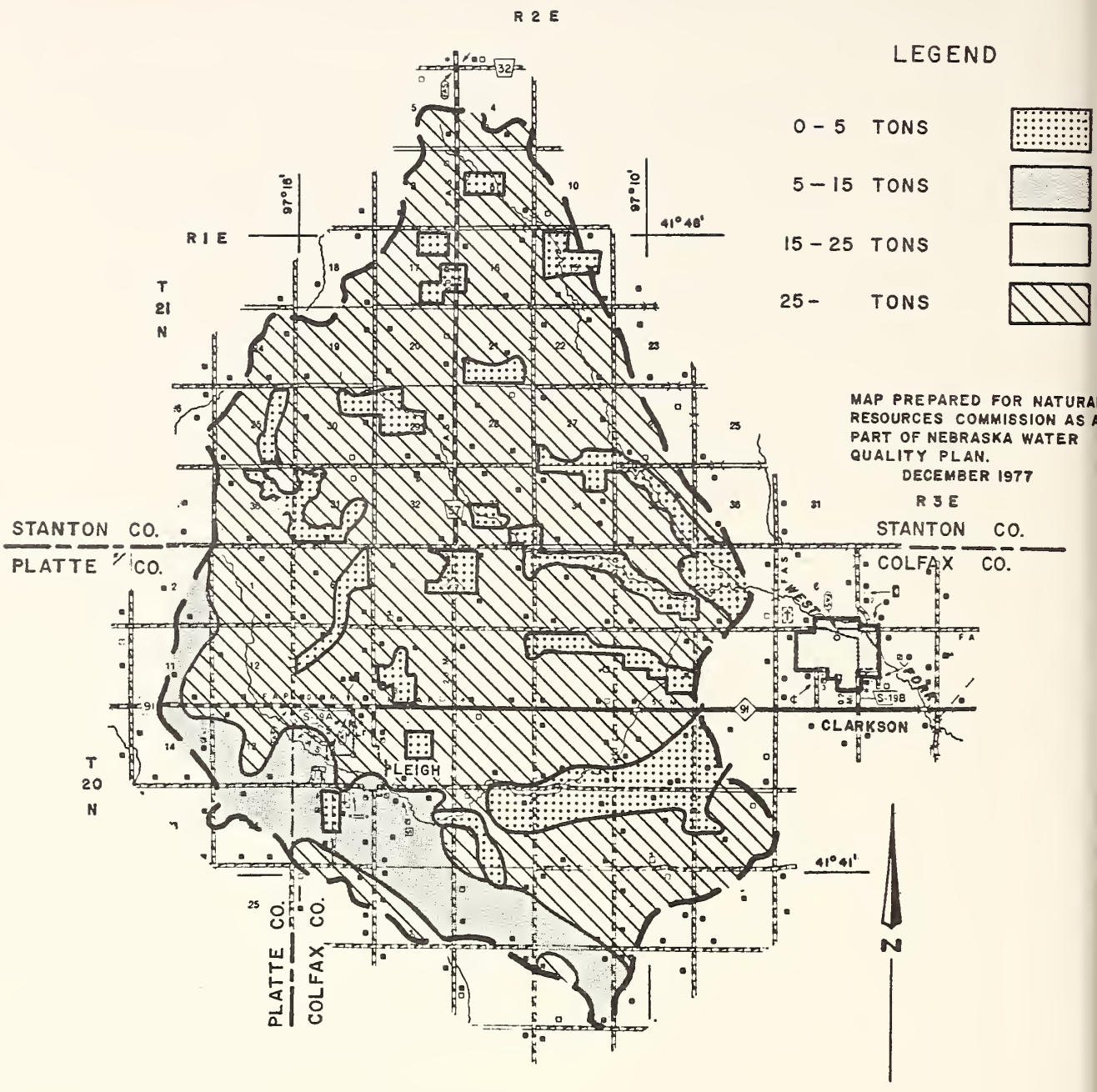


Figure 1

EROSION HAZARD MAP
MAPLE CREEK MIP AREA
COLFAX, PLATTE
AND
STANTON COUNTIES, NEBRASKA

SOURCE:
LATEST DATE COUNTY HIGHWAY MAP AND INFORMATION FROM FIELD TECHNICIANS.
LAMBERT CONFORMAL CONIC PROJECTION
USDA-SCS-LINCOLN, NEBR. 1978

1/126,720

0 1 2 3 4 MILES

0 1 2 3 4 5 6 KILOMETERS

SCALE

6-6-78
5,L-36,930

These measures will reduce the delivery of sediment, pesticides and fertilizers into waterways.

Cost share funds have not usually been fully utilized even though soil erosion in the watershed has been high. The $2,500 per operation limit of cost sharing may have contributed to underusage. The use of conservation practices and management systems and the number of watersheds has been much lower than most other southeastern counties where soil erosion is almost as severe.

Objectives

The purpose of this study was to examine participation rates in soil conservation practices in an area where soil erosion is severe. Specific objectives were to:

1. Determine the kinds and extent of use of conservation practices and tillage methods.
2. Assess operators' and landlords' perception of soil erosion problems and the need to control erosion.
3. Determine the influence of selected economic, physical, personal and institutional factors on the adoption of practices and tillage methods.
4. Determine the implications for operator and landlord participation in voluntary conservation.

Procedures

A goal of Nebraska'a 208 Planning Process is to recommend programs to achieve water quality goals. A survey was taken of farms in the Maple Creek MIP to provide information in the use and acceptance

of selected conservation practices and methods designed to reduce erosion and improve water quality.

Sample and Reliability

Data were collected from 106 farm operators and 69 landlords in a 34,000 acres subarea of the Maple Creek MIP in Colfax, Platte and Stanton Counties.[1/] The target population was 165 operators and their landlords (if any). All farm operations under the control of a farmer were treated as the sampling unit to avoid interviewing farmers with more than one farm unit in the area more than once. Total farm operating units exceed the population of operators from which the sample was taken.

Questionnaires

Earlier work by Blase (1) and Held (3) contributed much in the development of the questionnaires and methodology used in this report.[2/] Separate questionnaires were used to interview operators and landlords. This comprehensive approach provides responses not only from the tenants but also landlords concerning a given soil erosion problem. Information was collected on (1) soil erosion problems; (2) problems associated with selected practices and methods; and (3) possible solutions to these problems. SCS provided information on the soil erosion potential, farm plans and technical assistance provided each farm. The questionnaire was developed for a study

1/ See Appendix I for more detail.
2/ Underscored numbers in parenthesis refer to references listed at the end of this report.

of participation in two areas of Nebraska. The Maple Creek MIP is located in one of the study areas.

Survey Response

A sample of 106 operators was drawn from a population of 165 operators in the Maple Creek MIP. Usable questionnaires were obtained from 106 operators including alternates for one operator who had died and two that could not be located. In addition, 69 landlords were interviewed. Names and addresses of landlords were obtained from tenants and part owners. In cases where there was more than one landlord for an operator, the one renting the most land to the operator was identified as the main landlord. In some cases, more than one landlord was interviewed for the same farm but the main one was used for comparative purposes.

Description of Study Area

The Maple Creek Watershed is located about 100 miles north of Lincoln, Nebraska in Colfax, Cuming, Dodge, Platte and Stanton Counties. A subwatershed, the Maple Creek MIP area, was selected for monitoring water quality and for installing conservation and pollution control measures on an accelerated but voluntary basis. The subwatershed is the Middle Fork and West Fork drainage areas above Clarkson, Nebraska. The area covers about 33,000 acres in Colfax, Stanton and Platte Counties.

The area is hilly with undulating slopes of 6 percent or more. The predominate soil series are Nora, Crofton and Moody. Rainfall averages 26 inches a year but becomes intense in the spring. The

combination of these soils, steep slopes, high intensity rains and row crops creates a soil erosion potential of over 25 tons of soil loss annually.

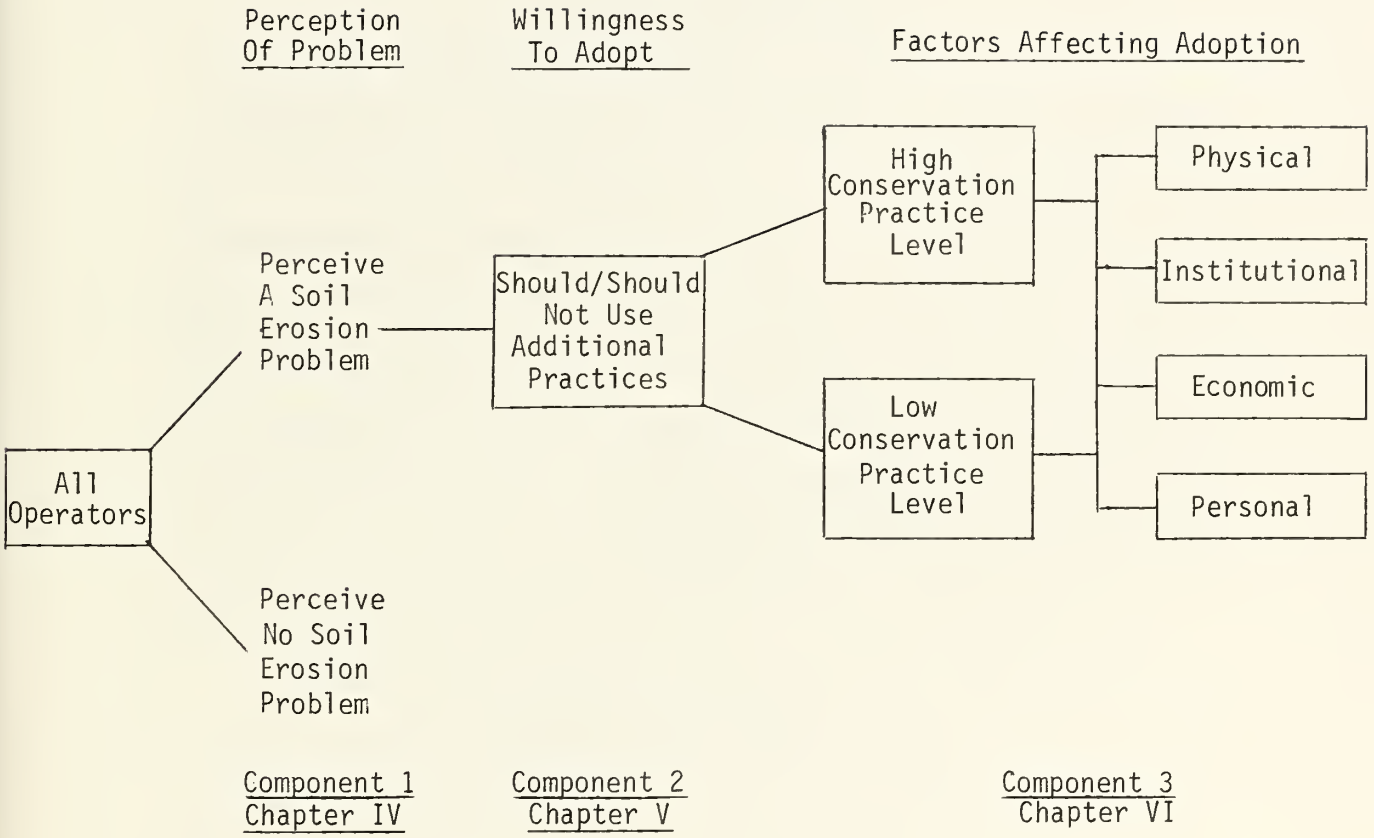
Soil productivity has been maintained with adequate fertilization and timely rains even though most of the topsoil has eroded. The maintenance of productivity has offset the need to adopt soil conserving practices. However, this trade-off between soil loss and increased fertilization may change as fertilizer prices rise and awareness of water quality problems increases. Farmers may find selected soil conservation practices and tillage systems more desirable and profitable in both the short and long run.

Analytical Framework

Low adoption rates are the product of an extremely complex social, cultural, economic and physical systems. These complexities make the task of identifying factors which lead to low adoption of numbers of conservation practices more difficult. While it will be possible to empirically identify some of the reasons for low adoption rates, other reasons can only be advanced on the basis of general insight into the nature of the problems within the region.

The study is partitioned into three analytical components for addressing problems (Figure 2). Component 1 describes and compares perspectives on soil erosion in the Maple Creek area. Particular emphasis is given to examination of factors which might influence differences between operators and the SCS classification of potential soil erosion. Component 2 focuses on those operators who indicate

FIGURE 2


Perception Of Problem
Willingness To Adopt
Factors Affecting Adoption
All Operators
Perceive A Soil Erosion Problem
Perceive No Soil Erosion Problem
Should/Should Not Use Additional Practices
High Conservation Practice Level
Low Conservation Practice Level
Physical
Institutional
Economic
Personal
Component 1 Chapter IV
Component 2 Chapter V
Component 3 Chapter VI

the existence of a soil erosion problem. The primary interest here is a determination of their willingness to adopt more conservation practices. Component 3 identifies operators who indicate a soil erosion problem exists and identifies factors which influence their adoption of conservation practices.

Statistical Procedures

Stepwise discriminant or classification analysis was used to select for further analysis variables important in distinguishing between operators who did and did not indicate a soil erosion problem.3/ Nonparametric tests of independence and association were performed for those variables selected by the discriminant procedure to determine the nature and strength of the dependency between the selected variables. Multiple linear regression was employed to determine variables which were important in explaining the number of conservation practices adopted.4/

The descriptive phase identifies operator, landlord and farm characteristics as well as current conservation practices and practices which operators indicate they should be using and use of recommended practices for the area. The analytical phase examines perceptions of the soil erosion problem, relation between perception of the problem and adoption and factors affecting adoption of conservation.

3/ For a brief description and more extensive application of the discriminant analytical procedure see David Carvey, Location Development Preferences and Socioeconomic Structure in the Resource Conservation and Development Program, Economic Research Service, USDA, AGERS-25.

4/ These statistical tests can be found in W. J. Conover, Practical Nonparametric Statistics, (New York: John Wiley & Sons, 1971).

OPERATOR, LANDLORD AND FARM CHARACTERISTICS

Operator, landlord and farm characteristics likely influence attitudes toward participation in conservation practices. The purpose of this section then is to describe significant characteristics and their association with selected practices and tillage systems.

Age of Operator and Landlord

Operators are evenly distributed between the ages of 25 and 64 years with only a few under 25 and over 65 (Table 1). The median age of operators was 45. The sample is only slightly younger than the average of 50 years of age for the state.

As was expected, landlords are generally older; two-thirds were over 65 years of age. Also, younger operators (less than 35 years of age) were less likely to have been a cooperator in the conservation programs with ASCS and SCS during the past 5 years than older operators (Table 2).

Tenure by Type of Operator

Operators had spent an average of 18 years on the present farms. Two-thirds of the tenants have been on the current farm less than 10 years while two-thirds of the full owners have been on the current farm 25 years or more (Table 3). Tenure of part owners were in between these two groups. However, there is no strong correlation between tenure and whether the operator was a cooperator (Table 4).

Table 1. Age of Operators and Landlords, Maple Creek MIP, 1977

Age	Operator		Main Landlord	
	No.	Pct.	No.	Pct.
Under 25 years	5	5	1	1
25 - 34 years	19	18	1	1
35 - 44 years	21	20	1	1
45 - 54 years	31	29	11	16
55 - 64 years	26	25	8	12
Over 65 years	4	4	47	68
Total	106	100[1/]	69	100

Chi-square statistics: $x^2 = 88.51$; d.f. = 5; significant at .01 level.

1/ Percentages may not add to 100 due to rounding error.

Table 2. Age of Operator by Cooperator in USDA Conservation Programs, Maple Creek MIP, 1977

Age of Operator	Cooperator[1/]					
	Yes		No		Total	
	No.	Pct.	No.	Pct.	No.	Pct.
Less than 25	4	8	1	2	5	5
25 - 34	3	6	16	29	19	18
35 - 44	10	20	11	20	21	20
45 - 54	18	36	13	23	31	29
55 - 64	14	28	12	21	26	25
65 and over	1	2	3	5	4	4
Total	50	100	56	100	106	100

Chi-square statistics: $x^2 = 12.4$; d.f. = 5; significant at .05 level.

1/ For the last five years.

Table 3. Number of Years Operating the Current Farm by Type of Operator, Maple Creek MIP, 1977

Years Operated This Farm	Type of Operator							
	Full Owner		Part Owner		Tenant		Total	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Less than 10	2	10	18	30	18	75	38	36
10 - 19	2	10	13	21	0	0	15	14
20 - 29	8	38	14	23	4	17	26	25
30 - 39	6	29	13	21	2	8	21	20
40 - 49	3	14	1	2	0	0	4	4
No response			2	3			2	2
Total	21	100	61	100	24	100	106	100

Chi-square statistics: $x^2 = 28.5$; d.f = 8; significant at .01 level.

Table 4. Number of Years Operating the Current Farm by Cooperator in USDA Conservation Programs, Maple Creek MIP, 1977

Years Operated This Farm	Cooperator[1/]					
	Yes		No		Total	
	No.	Pct.	No.	Pct.	No.	Pct.
Less than 10	15	30	23	41	38	36
10 - 19	5	10	10	18	15	14
20 - 29	13	26	13	23	26	25
30 - 39	12	24	9	16	21	20
40 - 49	3	6	1	2	4	4
No response	2	4	0	0	2	2
Total	50	100	56	100	106	100

Chi-square statistics: $x^2 = 4.17$; d.f. = 4; not significant at .05 level.

1/ For the past five years.

Off-Farm Work

Few operators were part-time farmers working off the farm. Eighty-one percent of the operators did not work off the farm and only 12 percent worked 200 or more days off the farm (Table 5). Off-farm employment did not appear to be a major factor in cooperation with SCS.

Disposal of Farms

Fifteen percent of the operators have plans to stop farming within five years (Table 6). Most of these operators were 55 years of age or older. Some 80 percent of the owner-operators do not plan to dispose of their farms during the next five years. This indicates some stability in past and future tenure on the farm. There was also stability in the landlord's ownership of their farms (Table 6). Only seven percent planned to dispose of their farms within the next five years.

"Leave as an estate" was the primary means of disposal of both operators (37 percent) and landlords (68 percent)(Table 7). Also, 18 percent of the operators plan to rent their farms when they quit farming. Thus, most operators and landlords will continue maintaining contact with their farms either through tenants or family estates.

Farm Characteristics

Type of Farm, Land Use and Size

Cash grain and livestock was the major farm operation

Table 5. Days Worked Off Farm by Cooperator in USDA Conservation Programs, Maple Creek MIP, 1977

Days Worked Off Farm	Cooperator[1/]					
	Yes		No		Total	
	No.	Pct.	No.	Pct.	No.	Pct.
None	42	84	44	79	86	81
Less than 200	3	6	4	7	7	7
200 and over	5	10	8	14	13	12
Total	50	100	56	100	106	100

Chi-square statistics: $x^2 = .54$; d.f. = 2; not significant at .05 level.

1/ For the past five years.

Table 6. Plan to Dispose of Farm in the Next Five Years, Maple Creek MIP, 1977

Operator and Landlord Response	Unit	Yes	No	Don't Know	Total
Operator plans to stop farming in next 5 years	No.	16	87	3	106
	Pct.	15	82	3	100
Landlord plans to dispose of farm in next 5 years	No.	5	55	9	69
	Pct.	7	80	13	100

$x^2 = 1.74$; d.f. = 2; not significant at .05 level.

Table 7. Method of Disposing of Farm by Owner-Operators and Landlords, Maple Creek MIP, 1977

Plans for Farm When You Stop Farming It	Owner-Operators 1/		Landlords	
	No.	Pct.	No.	Pct.
Rent out	15	18	NA	NA
Sell	6	7	6	9
Leave as an estate	30	37	47	68
Subdivide	1	1	1	1
Other	4	5	2	3
No response	26	32	13	19
Total	82	100	69	100

1/ Full owners and part owners.
χ^2 = .6; d.f. = 1; not significant at .05 level. Tests of independence were for the two groups, sell or subdivide and leave as an estate and owner-operator and landlords. Rent out did not apply for landlords.

in the Maple Creek MIP and included 86 percent of the farms (Table 8). However, there was no significant difference between type of operator and type of farm. Few specialized cash grain or livestock operators were found. Corn, pasture, soybeans and hay and small grain were the primary types of land use (Table 9). Corn accounted for some 12,000 acres of the 31,000 acres of land on the farms with an average of 115 acres of corn. (See Appendix III, items 3-5 for definitions.)

The average size of farm was 293 acres (Table 9). Full owner-operator farms tended to be smaller than part owner farms (Table 10). Part owners rented additional acres to increase the size of their operations above the typical full owner operation in the area.

Type of Farm Organization

The individual or family farm was the primary type of farm organization (94 percent)(Table 11). Only two percent of the full owner and part owner operations were incorporated and these reported fewer than 10 stockholders. The same percentage of farm corporations was reported for Colfax and Stanton Counties in the 1974 Census of Agriculture (7).

The Internal Revenue Service refers to businesses with 10 or less shareholders and who have elected to file under Subchapter 5 Corporations as a small business corporation or a closely-held corporation (6). While the survey did not determine if the incorporated farms had filed under Subchapter 5 or under the Ordinary Domestic Corporations Chapter (2), consultation with community leaders and enumerators did not indicate the presence of any large corporations, local or absentee, or foreign investors in the Maple Creek MIP.

Table 8. Type of Farm by Type of Operator, Maple Creek MIP, 1977

Type of Farm	Type of Operator							
	Full Owner		Part Owner		Tenant		Total	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Cash grain	2	10	2	3	2	8	6	6
Livestock	2	10	4	7	1	4	7	7
Cash grain & livestock	16	76	55	90	20	83	91	86
Other	1	5			1	4	2	2
Total	21	100	61	100	24	100	106	100

$x^2 = 2.32$; d.f. = 4; not significant at .05 level.

Table 9. Land Use by Acres,
Maple Creek MIP, 1977

Land Use in 1977	Total Acres	Average Acres	
		All Farms in Survey	Farms Reporting This Use
	Acres		
Corn	11,852	112	115
Soybeans	4,375	41	53
Grain sorghum	611	6	29
Silage	328	3	27
Wheat	184	2	20
Other small grains	3,486	33	41
Hay	3,978	38	41
Pasture	5,446	51	56
Other[1/]	1,560	15	18
Total	31,362	293	

1/ Includes house and lot if on the farm.

Table 10. Acres Operated by Type of Operator, Maple Creek MIP, 1977

Acres Operated in 1977	Type of Operator							
	Full Owner		Part Owner		Tenant		Total	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Less than 100 acres	4	19	2	3	4	17	10	9
100 - 199	10	48	15	25	9	38	34	32
200 - 299	3	14	9	15	2	8	14	13
300 - 399	3	14	12	20	3	12	18	17
400 - 499	1	5	14	23	3	12	18	17
500 - 599			2	3	2	8	4	4
600 and over			7	12	1	4	8	8
Total	21	100	61	100	24	100	106	100

$x^2 = 11.29$; d.f. = 4; significant at .05 level. Less than 100 and 100-199 were grouped and 200-299 and 300-399 were grouped for testing.

Table 11. Type of Farm Organization by Type of Operator, Maple Creek MIP, 1977

Type of Farm Organization	Type of Operator					
	Full Owner		Part Owner		Total	
	No.	Pct.	No.	Pct.	No.	Pct.
Individual or family	21	100	54	89	75	91
Partnership			3	5	3	4
Corporation 1/			2	3	2	2
No response			2		2	2
Total	21	100	61	100	82	100

1/ Corporation with less than 10 stockholders.

Soil Erosion Potential

Soil erosion continues to be an important conservation and environmental problem in the Maple Creek MIP with much of the land exceeding 25 tons of soil loss per acre annually (Figure 1). Operators and landlords were asked to indicate whether, on their farms, soil erosion is: (1) a major problem; (2) somewhat of a problem; (3) a problem but needs no action; or (4) no problem. (See Appendix III, items 1-2 for definitions.) For comparative purposes in the analysis, operators and landlords were asked to assume conventional tillage and no conservation practices similar to the SCS soil erosion potential. Only two percent of the operators indicated their farms had a major soil erosion problem while 40 percent said there was no problem (Table 12). The landlord's responses for the same farms were similar--none had a major problem and 52 percent had no problem.

SCS county office staff was asked to rate the Soil Erosion Potential for the sample farms which assumes conventional tillage and on conservation practices. The Soil Erosion Potential on farms was classified by SCS according to: (1) high soil erosion problem; (2) moderate problem; (3) a low problem and (4) no problem. None were classified as having no soil erosion problem. Using this classification, SCS classified 82 percent of the farmsas having a high soil erosion potential while there were none without problems. There was a large difference in the classification of soil erosion problemsby SCS and the farm operators.

Table 12. Degree of Soil Erosion on Farms Classified by Operator, SCS and Landlord, Maple Creek MIP, 1977

Degree of Soil Erosion on Farms	Operator		SCS		Landlord	
	No.	Pct.	No.	Pct.	No.	Pct.
Major problem	2	2	87	82		
Moderate problem	47	44	15	14	30	43
Low problem	15	14	4	4	2	3
No problem	42	40			34	49
No response					3	4
Total	106[1/]	100	106	100	69	100

1/ Chi-Square Statistics: $\chi^2 = 729.8$; d.f. = 1; significant at .05 level. Major and moderate problems and low and no problems were grouped for testing operator and SCS categories.

CONSERVATION PRACTICES

This section describes the type of conservation practices and extent of use in the Maple Creek MIP in 1977. Operators were asked about practices that they are not now using but feel they should be using to control erosion to acceptable levels. Also attitudes on recommended practices were obtained.

Current Conservation Practices

Conservation practice use according to the operator's classification of the practices is presented in Table 13. Due to the numerous types, combinations and various modifications of practices, enumerators did not define a practice unless asked to by the operator. Operators indicated the use of these practices and were not asked to indicate effectiveness or extent of the practices used on farms.

Crop residue management and grassed waterways were used most frequently, 86 percent and 80 percent of the farms, respectively. Other high use practices were stubble mulching (47 percent), reduced tillage (44 percent), structures (40 percent). Contouring, strip-cropping and terraces were limited in use. Over 95 percent of the operators plan to continue using these practices. However, local SCS staff indicate that most practices are not being used widely enough to efficiently control erosion in the area.

Practices Operators Think They Should Use

The previous section covered practices that operators used in 1977. This section describes those practices that operators did not use in 1977 but indicated that they should be using (Table 14).

Table 13. Use of Selected Conservation Practices, Maple Creek MIP, 1977

Conservation Practices	Operators Using These Practices	
	Number	Percent
Crop residue management	91	86
Waterways	85	80
Stubble mulch	50	47
Reduced tillage	47	44
Structures	42	40
Contouring	30	28
Windbreak & forest tree planting	24	23
Strip-cropping	23	22
Legume rotations	20	19
Terraces	17	16
Animal waste control facilities	9	8

Table 14. Operator Response to Practices They Should Be Using, Maple Creek MIP, 1977

Conservation Practices	Operator Response to Selected Practices	
	Not Using These Practices	Should Use These Practices[1/]
	Number	
Contouring	76	14
Strip-cropping	83	3
Terraces	89	21
Reduced tillage	59	15
Stubble mulching	56	4
Crop residue	15	0
Grassed waterways	21	14
Grade stabilization structures	64	5
Dams	70	17
Agricultural waste management	97	1

1/ Conservation practices operators feel they should use but are not now using.

Purpose of this procedure was to identify those practices that are of interest to operators and highlight the reasons why they are not now using them. A further purpose was to determine if operator's current conservation efforts allow farmers to achieve their conservation goals.

Half of the operators indicated that there was conservation practices that they should use but are not now using. A gap exists between operator's use of conservation practices and their perception of the need for more practices. These results correspond closely to the finding that the proportion of operators who see the need for additional practices (50 percent) is similar to the proportion that see a major to moderate soil erosion problem exists (46 percent) on their farms (Table 12). Table 14 identifies those practices that operators are not now using but feel they should be using. Terraces, dams, reduced till, contouring and grassed waterways were the most often mentioned BMP practices. If cost sharing were available, these may be the BMP's most readily received and adopted by Maple Creek operators. Table 15 is a list of the reasons operators have not installed these practices. The tenant's major problem was that the landlord objected. Extra work, machine difficulties and low levels of cost sharing are important but not necessarily mutually exclusive reasons for not using practices that operators believe they should be using.

Table 15. Reasons For Not Using Practices Operators Feel They Should Use, Maple Creek MIP, 1977

Reasons For Not Using Desired Practices	Practices Operators Feel They Should Use But Are Not Using									
	Con-touring	Strip-cropping	Terraces	Reduced Till	Stubble Mulch	Grassed Water-ways	Grade Stabilization Structures	Dams	Agricultural Waste	Total
	Number of Operators									
Landlord objects	2	1	6	2		3	2	5		21
Machine difficulties	5	1	7	5	1					19
Cost not shared or not shared high enough	2	1	4				1	3		11
Other	4		3	5	3	9	2	5		31
No response	1		1	3		2		4	1	12
Total	14	3	21	15	4	14	5	17	1	94

Relation to the 208 Water Quality Program

Congress enacted the Federal Water Pollution Control Act "to restore and maintain the chemical, physical and biological integrity of the nation's waters". Section 101(a)(1) of the Act establishes a national goal to eliminate the discharge of pollutants into waters by 1985.[5/]

Section 208 of this Act is entitled "Area-Wide Waste Treatment Management" and calls for a process to identify, if appropriate, agriculturally and silviculturally related nonpoint sources of pollution, including runoff from manure disposal areas and from land used for livestock and crop production, and to set forth procedures and methods (including land use requirements) to control, to the extent feasible, pollution from such sources. Inherent to Section 208 is a set of soil conserving practices and systems of farming that would reduce the amount of soil erosion on farms and reduce the quantity that may enter the nation's waters. The set of best management practices will vary from area to area and often from farm to farm.

Below is a list of conservation practices identified in the Plan of Work for the Maple Creek MIP area to be funded under the Agricultural Conservation Program (ACP):[6/]

1 - Permanent native grass vegetative cover establishment

2 - Permanent vegetative cover establishment

5/ Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) Section 208(a)(2)(F).

6/ Maple Creek Model Implementation Project Work Plan, April 1978.

3 - Terrace systems

4 - Diversions

5 - Windbreak restoration or establishment

6 - Conservation tillage

7 - Water impoundment reservoirs

8 - Sediment retention, erosion or water control structures

9 - Sod waterways

10 - Animal waste control facilities

11 - Forest tree plantations

Table 13 lists a number of these practices and the percent of operators that used them in 1977. The lists of practices differ somewhat because the survey questionnaire was developed before the Model Implementation Project was authorized. The survey indicates a high acceptance of crop residue and grassed waterways but low acceptance of terraces.

Problems associated with practices in the Maple Creek area are presented in Table 16. The most common problem was the low level of cost sharing. The cost share rate was a particular concern for structural measures (terracing-66 of 106 operators, waterways-60 of 106 operators and structures-71 of 106 operators). Short rows and machine difficulties were problems associated with contouring and terracing. Table 17 shows what the sample operators think is the appropriate level of cost sharing for these practices. Three-fourths of these operators thought the level should be 90 percent or more for these practices (Table 17). At the same time, most

Table 16. Problems With Selected Recommended Practices, Maple Creek MIP, 1977

Problems Suggested by Operators[1/]	Selected Recommended Practices							
	Con-touring	Terraces	Water-ways	Strip-cropping	Structures	Reduced Till	Crop Rotations: Without Grasses or Legumes	Crop Rotations: With Grasses or Legumes
	Number of Operators[2/]							
Low cost sharing	37	66	60		71	25	15	34
Short rows	36	37						
Machine difficulties	20	25	1	1	2	10		
Debt and other expenses	15	15	15	14	15	15	15	15
Too much time	10	9	8	2				
Short tenure	8	8	8	8	8	8	8	8
Rental arrangement	6	8	7	6	9	6	6	7
Size of farm	6	8	6	6	6	6	6	6
Inflexible farm plan	5	7	6	5	11	6	5	5
Type of farm	4	3	1	4	2	2		
Decreases production						14		1
Other	11	16	10	3	16	13	18	2

1/ Multiple responses were permitted.
2/ Number of operators responding out of 106 total operators.

Table 17. Operators Suggested Level Of Cost Sharing For Selected Conservation Practices[1/], Maple Creek MIP, 1977

Selected Conservation Practices	Unit	Operators Suggested Level of Cost Sharing							
		Less than 75%	75-79%	80-84%	85-89%	90-94%	95% and over	No Response	Total[2/]
Structures	No.	5	6	5	1	40	14		71
	Pct.	7	8	7	1	56	20		100
Terraces	No.	3	6	3		33	19	2	66
	Pct.	5	9	5		50	29	3	100
Waterways	No.	7	5	1	1	31	13	2	60
	Pct.	12	8	2	2	52	22	3	100
Contouring	No.	4	1	1		21	9	1	37
	Pct.	11	3	3		57	24	3	100
Crop rotations with grasses or legumes	No.	11	1	3	1	15	1	2	34
	Pct.	32	3	9	3	44	3	6	100
Reduced till	No.	3		1		13	2	6	25
	Pct.	12		4		52	8	24	100

1/ Cost sharing for installation.
2/ Totals refer to those operators who said cost sharing was a problem.

operators did not think cost sharing was a problem with contouring, crop rotations with grasses or legumes and reduced tillage. Since only 28 percent of the operators were using contouring, 6 percent were using crop rotation and 44 percent were using reduced tillage, there must be other factors besides cost sharing that is associated with these low adoption rates. These factors will be explored later.

Method of Cost Sharing

Operators and landlords were asked the method of payment that would encourage the most conservation on their farms (Table 18). About half of both groups preferred increased cost sharing. Another 18 percent of the operators and 20 percent of the landlords wanted tax credits as a means of sharing the costs of conservation practices on their farms. Low interest loans were preferred by 16 percent of the operators and 9 percent of the landlords. Thus, farmers probably expect greater financial benefits from direct income transfers than through indirect aid from tax credits and low interest loans. For instance, farm real estate taxes claimed about six percent of the total production expenses in Nebraska between 1967 and 1976. In absolute terms this was almost $2,300 in taxes per farm in 1976 (4).

Table 18. Method of Financing by Operator and Landlord Response, Maple Creek MIP, 1977

Method of Financing Conservation Practices	Operator Response		Landlord Response	
	Number	Percent	Number	Percent
Low interest loans	17	16	6	9
Tax credits	19	18	14	20
Increased cost sharing	53	50	29	42
Doesn't matter	4	4	3	4
No response	13	12	17	25
Total	106	100	69	100

$x^2 = 1.58$; d.f. = 2; not significant at .05 level.

PERCEIVING THE SOIL EROSION PROBLEM

The level of soil erosion control practiced in an area is likely to be strongly influenced by the way operators and landlords perceive the severity and nature of soil erosion on their farms. While many factors influence the adoption of conservation practices, erosion control is unlikely to occur if operators (and/or landlords) do not in general view soil erosion as a problem. The purpose of this chapter is to examine the role of the farmer's perception of soil erosion in determining the level of soil erosion control in the Maple Creek area.

General Perception Levels

The results of the survey point to a large disparity in the severity of soil erosion on farms in the Maple Creek area as perceived by the Soil Conservation Service staff and operators or landlords. The Soil Conservation Service classified 82 percent [77, 87] of the farms as having a major soil erosion problem while only two percent [1, 7] of the operators and none [0, 8] of the landlords classified their farms similarly (Table 12).[7/] Moreover, 54 percent of the operators and 55 percent of the landlords indicated either no or a low soil erosion problem on their farms; yet, the Soil Conservation Service classified only four percent of the farms in these categories.

7/ Bracketed terms following sample percentages in text or tables provide low and upper limits between which one can be 95 percent confident the true population percentage falls.

For the area as a whole, operators and landlords are in general agreement about the problems presented by soil erosion. However, when considering their assessment of individual farms, considerable disagreement existed. The sample data in this table does not support the proposition that a tenant's perception of the soil erosion problem on his farm is influenced by the landlord's views or vice versa.

Tenant: Soil Erosion Problem	Landlord: Soil Erosion Problem: Yes		: No		: Total	
	No.	Pct.	No.	Pct.	No.	Pct.
Yes	22	69	22	65	44	67
No	10	31	12	35	22	33
Total	32	100	34	100	66	100

$x^2 = 0.12$; d.f. = 1; not significant at .05 level

It might be expected that different types of operators (full owner, part owner and tenant) would classify soil erosion problems differently. To explore this possibility all operators were asked if soil erosion was a problem. When responses were classified by type of operators, there was no statistical basis to infer for the entire area that these operator classes perceive the problem differently. The differences that do appear in the sample data could quite likely be the result of sampling variability.

Since those operators classified as part owners have characteristics similar to those of the other two classes, a more meaningful comparison can be made between full owners and tenants. Of these

Soil Erosion Problem	Type of Operator						Total	
	Full Owner		Part Owner		Tenant			
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Yes	9	43	39	64	16	67	64	60
No	12	57	22	36	8	33	42	40
Total	21	100	61	100	24	100	106	100

$x^2 = 3.42$; d.f. = 2; not significant at .05 level

two groups a significantly larger percentage of tenants indicated soil erosion difficulties. Two-thirds of the tenants indicated a problem on their farms whereas only 43 percent of the full owners felt similarly. This difference points to one possible avenue for exploring those factors responsible for different perception levels.

Examining Perception Differences

In general, the Maple Creek operators and the Soil Conservation Service do not agree in their classification of soil erosion problems. The nature of this disagreement is not, however, known. Further examination on a farm basis is needed to determine if operators and the Soil Conservation Service are defining the problem in different terms.

The Soil Conservation Service measures the soil movement to determine the degree of the soil erosion problem or soil erosion potential. When defined this way, there is always some soil movement and, therefore, some degree of problem. Operators, on the other hand, are less likely to evaluate the soil erosion problem in terms of soil movement

than by the effect of erosion on the cost and operational aspects of the farming operation.

Whether the level of soil loss is being viewed by operators as presenting cost, operational and other difficulties for their farming operations should be discernable from the data in Table 19. On each farm the operator's indication of a soil erosion problem was cross-classified against the Soil Conservation Service's soil erosion potential designation. If the level of soil loss is creating problems for operators and these problems are seen as associated with soil erosion, one would expect strong agreement between the Soil Conservation Service and operators. That is, farms with high potential for soil erosion as classified by the Soil Conservation Service would generally be classified by operators as producing a soil erosion problem and vice versa. However, the data in Table 19 provides no statistical basis to support the previous sentence. The Soil Conservation Service's classification of potential soil loss is not related to the operator's assessment of the presence of a soil erosion problem. Furthermore, a similar result is obtained for the landlord responses.

Factors other than differences in soil erosion problem definition may account for a substantial amount of the difference of opinion between the Soil Conservation Service and operators. In another sense the factors may be indirectly responsible for problem definition disparities. To the extent possible these considerations are explored more fully. Both type and amount of survey data, however, restrict the scope of consideration. The questionnaire was not developed for

Table 19. Operator, Landlord and SCS Classification of Soil Erosion Problems on Farm, Maple Creek MIP; 1977

Item	Soil Erosion Potential on Farms, SCS Classification							
	High		Moderate		Low		Total	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Erosion a Problem:								
Operator:								
Yes	52	60	9	60	3	75	64	60
No	35	40	6	40	1	25	42	40
Total	87	100	15	100	4	100	106	100
Landlord:								
Yes	26	52	5	42	1	25	32	48
No	24	48	7	58	3	75	34	52
Total	50	100	12	100	4	100	66	100

Operator: $x^2 = .07$; d.f. = 2; not significant at .05 level. Moderate and low categories grouped for testing.

Landlord: $x^2 = 1.02$; d.f. = 2; not significant at .05 level. Moderate and low categories grouped for testing.

this purpose. In some instances it is only possible to speculate on possible reasons for differences in operator responses to the presence of soil erosion. These reasons are noted with the hope that subsequent surveys and analyses can add to the knowledge on soil conservation and erosion control by either substantiating or refuting the validity of these speculative propositions.

Factors Influencing Perception Differences

Since an operator in most instances must perceive a problem with soil erosion before he is likely to practice greater soil erosion control, an attempt is made here to isolate those factors associated with operator soil erosion perceptions. Identifying factors influencing perception may provide useful information for formulating soil erosion control policy and programs. Accomplishment of this task is attempted by searching for a set of factors important in distinguishing between operators who do and do not indicate a soil erosion problem on farms which the Soil Conservation Service has classified as having a high soil erosion potential. The variables selected for the analysis can be categorized into three general groups of characteristics: physical, institutional and personal. Variables appearing in these categories are as follows:

Physical:

(1) Total acres farmed

(2) Total acres owned

(3) Acres irrigated

Institutional:

(4) Type of farm (family, partnership, etc.)

(5) Type of rental agreement

(6) Length of rental or lease agreement

Personal:

(7) Age of operator

(8) Days worked off the farm by operator

(9) Years on current farm

Discriminant analysis was used to select for further analysis variables important in distinguishing between operators who did and did not indicate a soil erosion problem. For those variables selected by the discriminant procedure, nonparametric tests of independence and association were performed to determine the nature and strength of the dependency between the above factors and the operators indication of the existence of a soil erosion problem.

Of the three categories only the personal characteristics were important in separating operators into the two response groups. For the three personal characteristics the discriminant procedure selected operator age as the most important variable followed by number of years on currently occupied farm. Days worked off the farm was not considered important in distinguishing between groups.

To determine more fully the nature of the relationship between erosion responses and operator age, operator responses were classified according to the following scheme:

Soil Erosion: Problem	Operator Age											
	Under 25		25-35		35-45		45-55		55-65		65 & over	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Yes	4	80	14	74	12	57	22	71	9	35	3	75
No	1	20	5	26	9	43	9	29	17	65	1	25
Total	5	100	19	100	21	100	31	100	26	100	4	100

$x^2 = 11.32$; d.f. = 5; significant at .05 level.

A greater proportion of younger operators agreed with the Soil Conservation Service that soil erosion problems existed. This dependency is sufficiently strong to suggest its presence within the entire Maple Creek area. The younger an operator, the more likely he is to indicate a soil erosion problem where the Soil Conservation Service indicates there should be one. However, he is less likely to be a cooperator (Table 2).8/

When the operators are classified as to whether they resided less than ten or ten or more years on their farms, an interesting relationship surfaces. Operators residing the shorter number of years on their farm (less than ten years) were by far more inclined to agree with the Soil Conservation Service about the potential difficulties soil erosion could pose on their farms. About 73 percent of the short term operators perceived a soil erosion problem as compared to 54 percent for the long term operators. This sample difference is statistically significant and suggests that the longer

8/ A possible explanation for this discrepancy is that adoption of conservation practices requires time as well as financial ability.

Soil Erosion: Problem	Years On This Farm: Less Than Ten Years		Ten Years And Over	
	No.	Pct.	No.	Pct.
Yes	24	73	38	54
No	9	27	33	46
Total	33	100	71	100

$x^2 = 3.46$; d.f. = 1; significant at .10 level.

an operator is in residence the less likely he is to agree with SCS that a problem is presented by soil erosion.

A note of caution should be interjected here with regard to the possiblity of misinterpreting the personal characteristics analyzed above as causes or reasons for the way operators respond. Other and probably much more complex factors which are strongly associated with operator age and length of occupancy may be responsible for operator response. For instance, operators may be responding only to the actual soil loss while others may be responding to the consequences of soil loss. With regard to this first type of reaction, the presence of high soil erosion throughout the area may obscure the operator's perception of the severity of the problem. An operator who has become accustomed to soil erosion may not have a basis for evaluating the degree of soil erosion; that is, soil erosion may be viewed as a fact of farming rather than seen as presenting a problem. This proposition is supported by previous analysis which found older operators and those residing the longest at their current locations are less prone to indicate a soil erosion problem.

Other reasons may also be advanced for the rather low proportion of operators indicating the potential for high soil erosion. If operators are responding to the economic consequences of soil loss, the presence of deep soils allows soil erosion to occur in the area with only minimal effects on the farming operation. Under such circumstances high soil loss may not result in perceptible economic consequences (like reduction in yield), physical problems or other difficulties. Another reason for the variation in operator responses arises when an operator recognizes that soil loss or its consequences is a problem but is unwilling to admit that it exists or that it is a major difficulty.

CHAPTER V
ATTITUDES TOWARD ADOPTING ADDITIONAL PRACTICES

Convincing operators that soil erosion presents a major problem for their farming operations does not assure a willingness to adopt higher levels of erosion control. In this chapter we wish to determine how willing operators are to practice higher levels of erosion control and what influence their perception of the soil erosion problem has on this willingness. Willingness is interpreted here to be signified by whether an operator feels he "should use" additional conservation practices. Moreover, the level of erosion control refers to the number of different types of conservation practices in which an operator is engaged and not how widely these practices are used throughout the farm.

Willingness To Use More Practices

Some 62 operators indicated a soil erosion problem existed on their farms. Of these only 41 (66 percent) felt they should increase the level of erosion control. The remaining 21 operators point out another obstacle on the road to increased levels of soil erosion control. While operators indicating no soil erosion problem would be expected to look unfavorably upon adoption of additional conservation practices, one would not expect a similar response for operators who indicate a soil erosion problem unless, of course, they are already practicing high levels of erosion control.

Despite the rather large number of responses to the classification depicting an unwillingness to adopt additional practices where a soil erosion problem has been indicated, a strong positive correlation

Soil Erosion Problem Exists	Should Use Additional Soil Erosion Practices					
	Yes		No		Total	
	No.	Pct.	No.	Pct.	No.	Pct.
Yes	41	79	21	40	62	60
No	11	21	31	60	42	40
Total	52	100	52	100	104	100

$x^2 = 19.52$; d.f. = 1; significant at .05 level.

exists between an operator's indication of the need to adopt more practices and his indication of the existence of a soil erosion problem. Operators indicating no soil erosion problem usually see little need for additional conservation practices.

Influence of Current Practice Levels on Desire for Additional Practices

The rather large and unexpected response to the category "no need for additional practices when a soil erosion problem exists" (21 of 62 operators) necessitates further examination to determine if current high levels of erosion control are responsible for this type of response. To facilitate this analysis the following frequency distribution for the number of current soil erosion control practices is constructed for the subclass of operators indicating a soil erosion problem.

Upon observing the "should not use" frequency distribution there is no basis to construe that large numbers of practices are responsible for an operator's unwillingness to adopt additional

Need For Additional Practices	Number of Current Conservation Practices							Total
	1	2	3	4	5	6	7 or more	
Should Use	2	5	4	8	6	11	7	43
Should Not Use	3	3	5	3	4	1	2	21
Total	5	8	9	11	10	12	9	64

$x^2 = 6.96$; d.f. = 6; not significant at .05 level.

practices (relatively fewer were using a larger number of practices). Also, for the entire group, it can be stated that an operator's desire to use additional practices is unrelated to the current number of practices used.

When attention was focused on the other operator subclass, those not indicating a soil erosion problem, high erosion practice numbers did not appear to be associated with the way they felt about using additional practices. This result was anticipated because operators who do not see a soil erosion problem were unlikely to entertain the thought of using additional conservation practices.

The above observations combine to lead one to an important generalization: Operators engaged in higher numbers of conservation practices and indicating a soil erosion problem are more likely than those with lower numbers to be receptive to additional practices. Although a number of reasons may be advanced for this condition, it is possible to conjecture that as operators become familiar with different types of practices they recognize the value of these practices, and therefore, are more inclined to believe additional

types of practices will produce similar results. Of course, the possibility also exists that operators with large numbers of practices were (in the past) inclined to practice (for whatever reasons) higher levels of erosion control but have reached a limit in the level of adoption because of certain obstacles. While still seeing the need for additional practices, they may be unwilling to adopt these for financial or other reasons. What obstacles may limit adoption of additional practices is the subject of study in the following chapter.

FACTORS AFFECTING ADOPTION OF CONSERVATION PRACTICES

This chapter takes a look at factors which are related to operator attitudes toward adoption of additional types of practices and the number of erosion control practices currently used by individual operators.[9/] An attempt will be made to identify not only factors which are important determinants of general soil erosion control levels but also those factors related to operator attitudes or willingness to adopt particular practices.

Factors Affecting Practice Numbers

The first step in achieving the above objectives was to select from the questionnaire a set of factors considered as potential determinants of conservation practice numbers.[10/] Eleven variables representing characteristics of both the operator and farming operation were selected for analysis. These are: (1) acres of irrigated land; (2) type of operator; (3) operators indication of the presence of soil erosion; (4) type of farming operation; (5) age of the operator; (6) number of days employed in nonfarm activities; (7) type of rental arrangement; (8) legal type of farm organization; (9) plans for farm upon retirement; (10) receipt of assistance from SCS or ASCS; and (11) operators indication of being on a farm plan.

The latter two variables merit particular attention and analytical treatment since they reflect the efforts of ASCS and SCS to

9/ Practices considered are contouring, terracing, waterways, stripcropping, structures and reduced tillage.

10/ By practice numbers is meant the number of different types of erosion control practices used.

increase soil erosion control. In contrast to the other variables there is the prior expectation that these two forms of cooperation will increase practice numbers. As will be seen, this prior knowledge on the direction of association and the fact that these two variables are highly correlated requires special statistical treatment for ascertaining their importance for erosion control practice numbers.

For analytical purposes the respondents are partitioned into two groups: (1) those with high erosion potential and (2) all farms irrespective of soil erosion potential. The former group, which contains about two-thirds of the respondents, is formulated to first control the confounding influence of changing conditions of soil erosion potential. The latter group is used to test whether soil erosion potential is a factor explaining the level of practices.

High Erosion Farms

Using a stepwise multiple regression procedure with an F-value of 4 as the criterion for inclusion (5 percent significance level), only the presence of a farm plan could be retained as a significant explanatory variable.11/ This single variable, however, accounted for only 10 percent of the variation in practice levels. The presence of the farm plan was found to increase the level of soil erosion control by 1.9 practices.

However, stepwise regression is useful in searching for explanatory variables. Results must be interpreted with caution. Exclusion

11/ See Appendix II Statistics No. 1.

of theoretically relevant explanatory variables may result in biased estimates of the regression coefficients. There is reason to believe that one such variable was excluded by the stepwise regression procedure; receipt of assistance from SCS or ASCS. This variable was excluded because of its high covariation with the farm plan variable ($r = .53$).

The high degree of covariation of the farm plan and assistance variables is not unexpected. Participation in a farm plan is one form of assistance. But assistance can also be obtained without participating in a farm plan. Because assistance can on its own merit be considered an important factor influencing soil erosion practice levels, there are prior grounds for retaining it as an explanatory variable. By not doing so the estimated coefficient for the farm plan variable will, by virtue of its covariation, erroneously pick up the explanatory influence of the assistance variable.

When the regression equation was reestimated including the assistance variable, these two variables combined to account for 11.5 percent of the variation in practice numbers--a 1.5 percent increase over just the farm plan variable.[12/] By introducing the collinear assistance variable the importance of the farm plan for increasing average practice numbers was reduced from 1.8 to 1.5, a reduction

12/ See Appendix II Statistics No. 1 and 2. Since we have prior expectations about the coefficient signs, a one tail t-test of significance is more appropriate than a two tail t-test. In this instance, the assistance variable is easily significant at the 15 percent level and nearly significant at the 10 percent level. The farm plan variable by the same token is highly significant at the 2.5 percent level.

presumably the result of bias mitigation. Furthermore, the receipt of assistance was found to raise average practice numbers by seven tenths of a practice. But because of the high variability of this estimate, its accuracy is called into question. However, there is reason to believe assistance does raise practice levels and the regression estimate is a reasonable assessment of its contribution to higher practice numbers.

All Farms

In the previous section the degree of soil erosion potential was held constant while investigating factors influencing erosion control practice numbers. Interest now focuses on whether this variable influences the number of practices. For this purpose attention is focused on all farms, encompassing all three erosion potential categories.

The same regression procedures as applied in the previous section are applied here. Once again all variables except the farm plan were excluded in the stepwise elimination procedure. For the theoretical reasons previously noted, the assistance variable was retained. The soil erosion was then added to these variables to determine if it contributed significantly to explaining changes in erosion control practice numbers.

The regression results for the farm plan and assistance variables were quite similar to those of the previous section. The farm plan was found to increase average practice numbers by 1.7 practices; assistance increased average numbers by only .4

practice.[13/] While the positive influence of the farm plan variable remained statistically significant at the one percent level, the positive influence of assistance could only be accepted at the 25 percent significance level. In spite of the poor showing of the latter variable it was retained to ensure unbiased estimates of the regression coefficients utilized to assess the impact of the other variables on practice numbers.

In the next step the regression equation was reestimated with the addition of the soil erosion potential variable.[14/] The addition of this new variable had little impact on estimates for the previous variables; this implies negligible covariation or association with the farm plan and assistance variables.

For the soil erosion potential variable one would at first expect higher degrees of soil erosion potential to be associated with greater numbers of erosion control practices. The appropriate test for this hypothesis entails an attempt to reject the null hypothesis that erosion potential has either no or a negative effect on practice numbers--requiring a one tail t-test. According to the regression an increase in soil erosion potential (a shifting to the next higher erosion potential classification) reduced erosion control by .4 of a practice--a result contrary to that expected. Since the coefficient is negative, there is no statistical basis to support the contention that higher potential for soil erosion will raise (by motivating operators to act) practice numbers.

13/ See Appendix II, Statistics No. 3.
14/ See Appendix II, Statistics No. 4.

In fact, the reverse appears to be true, reasons for which are not readily apparent.

One possible explanation exists for the negative relationship between erosion potential and practice numbers. On those farms with high potential for erosion the corrective actions for reducing soil erosion may be extremely complex and encompassing. Consequently, from a financial standpoint the types and breadth of application erosion control practices needed to mitigate soil erosion may be too formidable for the operator to undertake, perhaps even with government financial assistance. If this is indeed the case, practice numbers on farms with high levels of erosion potential will be lower than for those farms where the erosion control needs (and associated financial requirements for correction) are not so great.

The Effect of Obstacles on Erosion Control

A previous chapter already indicated the current feelings of operators toward the impact of certain economic, institutional and other factors (obstacles) on the selection of particular additional conservation practices. The question now arises as to whether these feelings were present in the past and thus are related to the present level of erosion control in the Maple Creek area. Moreover, does an operator's indication of a certain factor as being an obstacle to adoption of a practice also affect his willingness to adopt the practice? Only those operators indicating the presence of a soil erosion problem are considered.

Obstacles to Future Practices

For both the willingness to adopt additional practices and the current number of practices two general areas of operator concern surface as important influences. Both cost sharing and farm size appeared frequently for different types of factors as being strongly associated with an operator's current practice levels or indication of his willingness to adopt an additional practice. Insufficient cost sharing on installation and maintenance of a practice was found to also be associated with his unwillingness to adopt the practice. An operator's willingness to adopt a practice was also found to be strongly correlated for several practices with an operator's indication of whether farm size was a problem. The conjecture here is that operators with smaller farms are on the average less willing to adopt an additional practice.

Obstacles to Current Practices

An examination was made to determine if an operators current view on a particular factor being an obstacle to adoption of a practice was present in the past and influential in determining the current level of erosion practice. Only one general factor turned out to be significantly associated with current erosion practice numbers on farms--cost sharing. Operators who indicated that installation and frequently operation cost sharing as a problem in general had lower numbers of conservation practices on their farms. This result surfaced for all major practices except stripcropping.

IMPLICATIONS

Relation to the Rural Clean Water Program

Among other things, the Rural Clean Water Program (RCWP) provides that ESCS assist in the economic evaluation of best management practices and RCWP project plans; make data available from existing and planned ESCS surveys relating to conservation measures, water quality and related matters; and conduct socio-economic research, with ESCS authorities and funds, on relevant policy and program issues pertinent to RCWP. This study provides input into these areas.

Some 65 percent of the cropland in the Maple Creek Watershed needs treatment. This is reflected in the soil erosion potential of about 25 tons of soil movement per acre. The BMP's recommended for the area are presented on page 29 and the percent of sample operators using each are reported in Table 13. With the exception of waterways, the most popular practices have not been eligible for past cost sharing (crop residue management, stubble mulch, reduced tillage, etc.). These were practices that could be easily incorporated into the operations without much extra cost, extra labor or causing machine difficulties. The two major problems with BMP's cited by sample operators are the low levels of cost sharing and creation of short rows and machine difficulties. Operators probably are using all of the practices they plan to use under pre 1978 cost sharing arrangments. This statement is further supported by the fact that only two percent

of the operators and none of the landlords believe they have a major erosion problem. Operators suggested that the cost sharing level should be 90 percent or more. This appears to be the threshold level for adopting more practices (Table 17). The validity of this statement can be tested later since the Maple Creek MIP has received special funds for sharing operating costs of BMP's at 90 percent. Preliminary results indicates that 90 percent cost sharing is having a strong positive impact on practice adoption, particularly on structures (5).

This study further identified variables that were related to the number of conservation practices. The presence of a farm plan and technical assistance were found to be positively related to the number of practices on individual sample farms. The presence of a farm plan and technical assistance increased the average number of practices by 2.2 practices. Thus, governmental involvement by local, state and federal agencies exerts a positive influence on the level of conservation practiced in the Maple Creek MIP.

Obstacles to Soil Erosion Control

A major obstacle to improving the level of soil erosion control in the Maple Creek area is the lack of consensus by both operators and landlords that soil erosion presents any particular difficulty on their farms. One reason for the relatively low acknowledgement of this problem is a feeling by operators and landlords that high soil loss presents no particular or insurmountable economic, physical or other difficulty for their farming activities. For this group of operators, long term consequences of soil erosion are likely not

considered. Furthermore, the impact of soil erosion on water quality outside the farming operation is probably not considered in an operator's or landlord's evaluation of the soil erosion problem.

Of course, the process of formulating soil erosion perceptions is considerably more complex than indicated by the several topics discussed above; indeed, so complicated that more indepth study is warranted. But on the basis of this study, both at the empirical and theoretical levels, several observations can be discerned with important implications for conservation and water quality policy.

First, there appears to be a great need for implementing educational programs for fostering higher levels of concern for the consequences of soil loss. Concern by operators and landlords for the long term effect of soil loss on the quality and quantity of this nation's water resources should be encouraged. Additionally, the effect of soil loss on water quality should be made more explicit and understandable to foster concern by farmers for the external consequences of soil conservation inaction. An upgrading of this concern about the impact of soil erosion should be complemented by activities disseminating objective and concrete information on farm soil erosion conditions.

There is a need, as noted above, to cultivate a basic foundation of motivation--a propensity to act--before other programs or activities directed toward improved conservation can be successful without extreme cost to the general public. If this concern for the well-being of the public at large (water quality enhancement) is not achieved,

public actions required to bring about improved water quality could be extreme. These might include legislating standards for maximum levels of soil erosion, as has been done in some regions, with the possibility of creating extreme hardship for the agricultural community.

Another alternative is to provide increased economic inducements to improve soil conservation. Operator preference in this study was for increased cost sharing over other forms of monetary inducements. The preference level was 90 percent of installation costs.

The idea of fostering a stronger moral obligation to conserve the soil and reduce nonpoint pollution through an intense educational effort is only one step toward improving soil conservation. While moral obligation may provide the intrinsic propensity to act, it will not assure action by itself. Economic obstacles may be so great as to override any sense of moral obligation.

APPENDIX I
SAMPLING

Determination of Sample Size

The target population in the Maple Creek MIP was 165 farm operators. In addition a survey of landlords of tenants and part owner-operators was planned.

The level of confidence has been arbitrarily set at .95 and the level of precision at .05. Given these limits and the following formula (8):

$$n = \frac{Nz^2pq}{Nd^2 + z^2pq}$$

Where:

N = population-(165)
z = reliability @ 95% = 2
d = level of precision-($\pm$.05)
p = prop. of pop. with a certain char. (.73)
q = 1 - p
n = sample size

the sample size becomes 106 farm operations. In a previous study 73 percent of farm operators indicated that soil erosion was a moderate to severe problem on their own farm or neighbors' farms. We assume that farmers' reactions to many of the questions on this survey will follow a similar distribution.

Procedure

Operators and landlords were interviewed personally by trained enumerators. Survey responses were recorded on the appropriate operator or landlord questionnaire (see Appendix II). The enumerators were given one day of training on questionnaire content, terminology and the execution of the interview and were closely supervised the first week of enumeration. The survey was conducted between March and April 1978.

Survey Results

Usable responses were obtained from 106 operators in the survey area. One operator died and two could not be located. Alternates were selected from adjacent operators in the same township but inside the MIP area. The actual sample size obtained provided confidence at the 95 percent level and precision at .05.

Survey Externalities

Several factors were present that could have influenced the quantity and quality of operator and landlord responses. On the positive side, personal interviews were taken during the off-season for most operators allowing greater opportunity for interviews and more time for each interview. Both factors contributed to a 100 percent response rate and to a more detailed interview (few blank questions).

On the negative side, some operators were either organizing or thinking of strikes designed to win congressional support for a depressed farm economy. Also, conditions of the new set-a-side program were unclear at this time. Thus, a negative attitude was observed by field enumerators throughout the survey area.

APPENDIX II
STATISTICS

1. No. of practices = 7.7 - 1.9 operators plan. R^2= .100
   F =9.371

2. No. of practices = 8.1 - 1.5 operators plan - .7 assistance. R^2= .114
   (t-value: -2.01) (-1.14) F =5.349

3. No. of practices = 8.3 - 1.7 operators plan - .4 assistance. R^2= .118
   (-2.61) (-.75) F =6.832

4. No. of practices = 9.5 - 1.8 operators plan - .4 assistance - .4 soil erosion.
   (-2.67) (-0.71) (-1.19)
   R^2= .130
   F =5.049

APPENDIX III
DEFINITIONS

1. Soil Erosion Potential vs. Actual Soil Erosion

The soil erosion potential of a major portion of soils in the Maple Creek MIP is about 25 tons of soil loss per acre annually (Figure 1). The soil erosion potential is a physical measure used by SCS to indicate the level of soil erosion with the use of conventional tillage without other conservation practices. This technique is used when soil erosion data are not available in an area and is based, among other things, on the degree and length of slopes, soil types and amount and intensity of rainfall.

Actual soil erosion is soil erosion on farms under existing tillage systems and conservation practices.

Actual soil erosion in the Maple Creek MIP is slightly lower than the soil erosion potential since primarily conventional tillage and a limited number of practices are used. For example, the Maple Creek MIP Plan of Work indicates that 65 percent of the cropland needs treatment.15/

2. Operator vs. SCS Classification of Soil Erosion

Operators and SCS were asked to classify soil erosion problems on the same farms. Purpose of this question was to determine if operator and SCS has similar views of a common problem. Since actual soil erosion data were not available

15/ Maple Creek Model Implementation Project Work Plan, April 1978.

on sample farms, SCS used the soil erosion potential concept to identify problem farms. Operators were asked to identify the soil erosion problem on their farms assuming conventional tillage and no conservation practices were used. These assumptions by operators and SCS were necessary for valid comparisons. While this procedure has weaknesses, it was the best available technique due to a lack of actual soil erosion data. Thus for this study, operators and SCS were considered to be responding to similarly defined soil erosion problems or conditions.

3. Total Acres Controlled by Operators

This term refers to acres owned, rented to someone else, rented from someone else and others' acres (free use of land) in 1977.

4. Total Acres Operated

This term refers to all acres included in the farm operation of sample operators in the Maple Creek MIP in 1977. It excludes land rented to someone else. Land in farm operations but outside the MIP was excluded unless it was adjacent to the MIP and part of the main farm. Thus, acres operated will be equal to or less than total acres controlled.

5. Double Counting of Acres Operated

The 31,000 acres of land operated by 106 sample operators approaches the 34,000 acres operated by 165 total operators in the Maple Creek MIP. Two reasons may account for the large number of acres operated by sample operators. First, land adjacent to or land split by the Maple Creek boundary lines was

included in the sample operator's main farm operation. Second, many operators were part owners, thus, permitting some double counting of acres if both operators were included in the sample.

6. Cooperator

An individual (usually a farm operator), group of people or representative of a unit of government who has entered into an understanding, working arrangement or cooperative agreement with a local conservation district to work together in planning and carrying out soil and water resources use, development and conservation on specific land area.

7. Conservation Plan

A collection of material containing land user decisions and information requested by the land user for the conservation of soil, water and related plant and animal resources for all or part of the operating unit.

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